Total Airport Management

A holistic approach towards airport operations optimisation

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Overview

- DLR at a Glance
- Motivation for CDM and for TAM
- TAM Approach and Prerequisites
- TAM Benefits
6900 employees across 33 institutes and facilities at 13 sites in Germany


Research Areas
- Aeronautics
- Space Research and Technology
- Transport
- Energy
Aeronautics Portfolio
Air Transport Systems

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<th>Strategic Research Agenda</th>
<th>Tool and processes</th>
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<td>Including: efficiency, environment, security</td>
<td>Numerical simulation, experimental simulation, airborne simulation</td>
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Facilities – Aeronautics

- Research aircraft
- Cockpit simulators
- Tower simulator
- Airport simulator
- Compressor, combustion chamber and turbine test beds
- Autoclaves
- Material and structural test facilities
- Ground vibration test facility
- Wind tunnels*

* Predominantly under the auspices of German-Dutch Wind Tunnels (DNW)
The Air Transport System of the future will be characterized by
- Growing traffic
- Eco friendliness
- Increased Efficiency
- Safety and Security

Optimizing Air Traffic Management (ATM) and airport processes by
- New ATM- and Airport-Concepts
- Air-Ground-Integration
- Airport-Performance-Modeling
### Structure

**Departments**
- Air Transportation Control Assistance
- Pilot Assistance
- ATM Simulation Operations Control
- Human Factors
- Mgmt. Services
- Business Manager

### Resources
- **~ 140 employees:**
  - ~ 70 Scientists
  - 1 Guest Scientists
  - 8 PhD Students
  - 10 Diploma Students
  - 5 Trainees

### Infrastructure
- Fast-Time Simulation
- Human-in-the-Loop-Simulation
- Ground Operations
- Cockpit
- Data Links
- Test Aircraft
- Research Airport
- A-SMGCS Test
- GBAS

### Networks
- **AT-One**
- DLR Institutes
- Universities
- Industry
- Bodies / MoU / Action Plans
- Eurocontrol
- NASA / MIT / FAA
- EATRADA, ASDA,
Centre of Excellence for ATM
Independent
Innovative
Customer oriented
Complete Network of Research Facilities
AT-One - Facts & Figures

- Strategic Alliance of
  DLR Institute of Flight Guidance and
  NLR Air Transport Division
- Shareholders: 50% DLR, 50% NLR
- Locations:
  Braunschweig, Amsterdam, Brussels
- Total employees: ~ 280
- Yearly Turnover: ~ 35 M€
- Background: additional 1400 employees in Air Transport Research

One of the largest ATM research organisations in the world
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Airport Operations - something in common with…?

World Wide Web

SWIM
System Wide Information Management

Finding Information

Prepare and Deliver Information
Motivation - Current Challenges (I)

Currently European ATM-System is fragmented

- Various ANSPs (~40) control and steer
- virtually no information sharing between Airports
- Problems at one single airport escalate throughout the entire network

Insufficient share of information between stakeholders

- data incomplete, outdated, possibly unreliable or missing
- opposing targets due to competing interests
- no integrated approach connecting landside and airside
Stakeholders are opting for an optimization of their own processes and operations but:

- minor knowledge of impacts on other stakeholders caused by decisions made
- own process optimization suffer from limited “situational awareness”

Stakeholders are compromising the system by

- phantom flights - CFMU planning is based on wrong data
- resulting in an overdemand caused by phantoms -> SLOT!?
- selection of the best fitting phantom and cancels the remaining
A need for:

- a performance increase of the ATN
- more dynamic and responsive ways of incorporating the airspace users’ and passenger needs
- pro-active instead of re-active planning
- possibilities to cope with competing interests at an airport in a fair and transparent manner
- an increase of the predictability of the “system airport”

SESAR (Single European Sky ATM Research) prescribes a performance-based ATM-System. Therefore it is required:

**Only performance based airport processes enable a performance based Air Traffic Management System**
Overview

➤ DLR at a Glance

➤ Motivation for CDM and for TAM

➤ TAM Approach and Prerequisites

➤ TAM Benefits
Approaches - Information Sharing (I)

Local Optimization of individual Stakeholders
Building blocks… Airport-CDM as a Baseline…

- Collaborative Predeparture Sequence
- CDM in adverse conditions
- Collaborative Management of Flight Updates
- The Milestones Approach
- Variable Taxi Time Calculation
- Airport CDM Information Sharing
Approaches - Information Sharing (II)

A-CDM

Information Sharing between Stakeholders

Local Optimization of individual Stakeholders
CDM is currently largely limited to the tactical phase. There is a lack of (pro-active) pre-tactical and strategic planning between airport partners.

Planning

Despite being a pillar of the EUROCONTROL CDM Implementation Guidelines, real-time data sharing is still limited and therefore pro-activity limited, too.

Data Sharing

Limited flexibility in response to real-time events.

Flexibility

Still considerable “marketing” required to convince all airport partners of the benefits.

Currently, almost no common performance indicators exist.

Shared vision

“Study of airport processes associated with… common planning process, common situational awareness and common performance framework, as well as the tools to visualise the predicted performance… as these do not exist today, nor do the procedures”

SESAR (2.2.2) R&D Requirement 1

Where do we take Airport-CDM from here?
From A-CDM to TAM

Local optimization at airport stakeholders

Information Sharing among stakeholders

Joint Airport Operations Planning & Execution
  -> Global Optimization

NEED FOR IMPROVEMENT
TAM – Generic Requirements

**Agreed Performance Measures**

Common computer aided (performance) assessment and simulation. Common monitoring leading to a more adaptive system.

**Agreed Airport Configuration**

Representation of information via common displays based on common data sources.

**Agreed Performance Targets**

Creation, agreement and maintenance of the airport operational plan (AOP) including performance trade-off analysis.

**Improved Predictability**

Common decision-making for a leading to a common understanding of future system evolutions.
TAM – Main Prerequisites

A-CDM is the baseline

& TAM Concept

& Technologies / Facilities

- Airport Operations Control Center (APOCH)
- Interfacing with tactical management tools and centers (A-SWIM), integrating an Airport Operational Database (AODB)
- Development of new tools (e.g. Total Operations Planner – TOP)
- …

& Cultural Changes

- holistic approach integrating airside and landside
- benefits from global optimisation vs. local optimisation
- working together towards common agreed goals
- …
Approaches – Pre-tactical and Holistic Management

TAM
APOC

A-CDM

Deutsches Zentrum für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Approaches – Airport Operations Control Center (APOCH)
Approaches - Joint and Collaborative Negotiation

- creation of a joint and common situational awareness
- transparent and fair handling by introduction of strict rules and regulations
- taking into account sensitive business data and privacy
- „Use Cases“ for often recurring default situations
- enabling „What-If“-exploration to find alternative solutions
- introduction of an arbitrator
Approaches - Validation Plattform ACCES

> Validation Infrastructure: ACCES – Airport and Control CEnter Simulator

a working- and simulation environment and flexible infrastructure
Overview

دير at a Glance

Motivation for CDM and for TAM

TAM Approach and Prerequisites

TAM Benefits
TAM – Expected Benefits (I)

**Agreed Performance Measures**

- Based on commonly agreed performance indicators, TAM will allow for an assessment and visualization of future airport performance. Introduction common databases and systems.

**Agreed Airport Configuration**

- This will allow operators to configure the airport according to agreed “scenarios” most applicable at the time of decision.

**Agreed Performance Targets**

- Demand and capacity management are organized to meet agreed performance targets for different time horizons. Also able to change the performance objective.

**Improved Predictability**

- Based on an environment which is designed around the philosophy of information sharing. Past performance used to identify future requirements.
Agreed Airport Operations Plan (AOP)

AOP includes a performance level commitment to ATN

Early planning and pro-active operations increasing airport’s predictability; better resource utilisation…

NOP - receives early planning data for more efficient and optimal sector capacity and trajectory planning

The user’s wishes submitted by 4D-business trajectories potentially can be much more efficiently be incorporated
Conclusion

Total Airport Management (TAM)

- will be the successor of A-CDM, for pre-tactical planning and execution of AOP
- is the holistic approach (landside and airside) towards airport operations optimisation
- leads to commonly agreed performance targets - global optimisation @ airport
- will change stakeholders cultures…
The work of DLR in TAM context

Development of Concepts

- Operational-, technical-, simulation- and validation-concept
- Airport Operations Plan (AOP)
- Negotiation procedures (with system support)
- Bonus malus system (to avoid cheating)

Functionalities and Tools

- Flight planning system, Total Operations Planner (TOP)
- Client working positions
- Display for video wall
- Common used database
- Interfaces to tactical systems
- Simulation environment for test campaigns
- Systems for analyzing, rights control, data fusion etc.
Thank You!

Questions?

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